

REMARKS

Claims 11-13, 17, 18, 20, 21 and 27-30 are pending herein. By this Amendment, claim 11 is amended to include the subject matter of previous dependent claims 14 and 22, claim 12 is amended to include the subject matter of previous dependent claims 15 and 23, claim 13 is amended to include the subject matter of previous dependent claims 16 and 24, claim 17 is amended to depend from claim 11, claim 18 is amended to depend from claim 12, and claim 20 is amended to include the subject matter of previous dependent claim 25. Claims 14-16, 22-26 and 31 are canceled.

No new matter is added by this Amendment. The amendments to claims 11-13 and 20 merely incorporate into these independent claims the subject matter of claims previously dependent therefrom.

Entry of the amendments is proper under 37 C.F.R. §1.116 since the amendments: (a) place the application in condition for allowance for the reasons discussed herein; (b) do not raise any new issue requiring further search and/or consideration (since the amendments to the independent claims merely incorporate previously considered subject matter of dependent claims into the independent claims as discussed above); (c) do not present any additional claims without canceling a corresponding number of finally rejected claims; and (d) place the application in better form for appeal, should an appeal be necessary. The amendments are necessary and were not earlier presented because they are made in response to arguments raised in the Final Rejection. Entry of the amendments is thus respectfully requested.

In view of the foregoing amendments and following remarks, reconsideration of the application is respectfully requested.

I. Background

Claim 11 as amended recites a polishing pad used for polishing a semiconductor wafer, wherein the polishing pad comprises a base layer formed of nonwoven fabric and a porous surface layer formed of foamed polyurethane, and a content of zinc oxide (ZnO) included in the polishing pad is 200ppm or less at the ratio of zinc weight relative to the weight of the polishing pad.

As described on page 14, line 9 through page 15, line 8 of the specification, the present inventors found that minute polishing damages were generated by using a conventional finish polishing pad in a mirror-polishing process of a semiconductor wafer. The inventors examined the polishing damages generated in the polishing process, and found that the cause is zinc compounds (zinc oxide), which were added in manufacturing of the polishing pad for increasing hardness of a nonwoven fabric and as a stabilizer against light in a manufacturing step of urethane resin.

Accordingly, as recited in claim 11 after amendment, if a content of zinc oxide (ZnO) included in a polishing pad comprising a base layer formed of nonwoven fabric and a porous surface layer formed of foamed polyurethane is 200ppm or less at the ratio of zinc weight relative to the weight of the polishing pad, a semiconductor wafer can be finished without polishing damages and cloudiness. See page 8, lines 9-16; page 11, lines 4-17; page 19, lines 8-18; etc. in the specification.

II. Rejection Under 35 U.S.C. §102(e)/§103(a)

Claims 11-18 and 20-31 were rejected under 35 U.S.C. §102(e) or under 35 U.S.C. §103(a) as anticipated by or obvious over Cercone in view of Tomita. This rejection is respectfully traversed.

In section 5 of the Office Action, the Patent Office asserts that the claimed invention must have a structural difference from the prior art in order to patentably distinguish the

claimed invention from the prior art. The Patent Office then alleges that Cercone describes that the material, e.g., polymeric elastic member, is used for cleaning and polishing in col. 3, line 11 and clearly discloses other shapes, e.g., pads, in col. 1, line 31.

However, Cercone is completely different from the present invention. Cercone describes that a residual amount of zinc in the sponge material is 2 ppm or less, which seems to be similar to the present invention. However, Cercone describes in claim 1 "A method of cleaning a silicon material comprising: extracting residue from a polyvinyl acetal sponge material . . . contacting the silicon material with the sponge material to thereby clean said silicon material". As evident from this description, Cercone relates to a cleaning sponge for washing out sludge and the like remaining on a surface of a wafer after polishing. Such a cleaning sponge is completely different from the polishing pad for making a surface of a wafer flat with high precision (mirror-polishing) by eliminating the non-uniformity of surface roughness as in the present invention.

In addition, as described in col. 2, lines 24-26 and typically shown in Figs. 1-3 of Cercone, the cleaning sponge of Cercone has a cylindrical body and a plurality of projections extending from the body. It is obvious that such a cleaning sponge should not be used for making a surface of a wafer flat with high precision.

Further, as compared in terms of structures and materials, there are complete differences between the polishing pad of the present invention and the cleaning sponge of Cercone. The polishing pad of claim 11 as amended recites that the polishing pad comprises a base layer formed of nonwoven fabric and a porous surface layer formed of foamed polyurethane.

On the other hand, as described above, Cercone specifies in claim 1 that the material of the cleaning sponge is polyvinyl acetal. Further, regarding a conventional sponge used in polishing as described in col. 3, line 11 of Cercone, which is pointed out by the Examiner, the

sponge is referred to as a "roll", and also there is described in col. 3, lines 13-14, "which is a typical conventional polyvinyl acetal sponge material". That is, Cercone simply discloses cleaning sponge rolls substantially made of polyvinyl acetal, which are completely different from the polishing pad comprising a base layer formed of nonwoven fabric and a porous surface layer formed of foamed polyurethane as in claim 11 of the present application.

On page 5, lines 3-4 of the Office Action, it is alleged that the limitation of a nonwoven base material and foamed polyurethane is met by Cercone at col. 3, line 64. Applicants respectfully disagree.

Cercone describes in col. 3, lines 62-64, "The sponge material is shaped into the sponge roller device 10 by a molding process. In particular, a polyethylene, ABS, or the like material is formed." Cercone never teaches or suggests a base layer formed of nonwoven fabric and a porous surface layer formed of foamed polyurethane as in the polishing pad of the present invention.

As mentioned above, the cleaning sponge roll made of polyvinyl acetal of Cercone is used in the stage of removing sludge and the like remaining on a surface of the polished wafer, and is also completely different from the polishing pad in terms of not only the intended use but also in terms of the structures and materials.

Tomita does not remedy the deficiencies of Cercone. Tomita, as evident from claim 1, Figs. 1-6, etc., discloses a cleaning sponge similar to Cercone. In particular, it is described in claim 1 that "A method for thorough cleaning of a finely finished surface of an article of glass or metal by removing cuttings . . . fine particles from said surface, comprising scrubbing said surface by means of a cleaning roll having a surface layer of polyvinyl acetal porous elastic material", and the cleaning roll shown in Figs. 5-6 is almost the same as the cleaning sponge shown in Fig. 1 of Cercone. That is, Tomita simply discloses cleaning sponge rolls made of polyvinyl acetal like Cercone which are used for removing sludge and the like

remaining on the surface of the wafer after polishing, and are completely different from a polishing pad comprising a base layer formed of nonwoven fabric and a porous surface layer formed of foamed polyurethane as recited in claim 11 of the present application. Further, Tomita does not teach or suggest making a content of zinc oxide small as in the present invention.

On page 5, lines 4-6 in the Office Action, it is alleged that a polyvinyl acetal based resin may be used for a porous abrasive polishing tool along with a polyester based resin as evident by the cited reference Toyama.

Toyama, as obvious from col. 1, lines 5-7, claim 1, Fig. 7, etc., relates to a grinding method (tool) for grinding a surface of a roll such as gravure printing copper-plated roll, and not to a polishing pad for polishing a surface of a flat semiconductor wafer as in the present invention. Further, Toyama describes in claim 1 that the grinding tool has an abrasive surface comprised of abrasive grains contained in a cured resin. It is obvious that such a grinding tool having a surface comprised of abrasive grains cannot be used for polishing a semiconductor wafer requiring flatness with high precision. Further, as for the resin of the surface of the tool, although there are cited polyvinyl acetal, polyester, and the like in claim 7, etc., Toyama does not teach or suggest a porous surface layer formed of foamed polyurethane as in claim 11 of the present application.

The grinding tool used for grinding a surface of a roll by Toyama has no relation to the polishing pad for polishing a surface of a flat semiconductor wafer as the present invention.

Toyama thus also fails to remedy the deficiencies of Cercone.

As mentioned above, cleaning sponges made of polyvinyl acetal used after polishing as disclosed by Cercone and Tomita are obviously different from the polishing pad comprising a base layer formed of nonwoven fabric and a porous surface layer formed of

foamed polyurethane claimed in claim 11 of the present application in terms of not only intended use but also structures and materials. Further, the grinding tool for grinding a surface of a roll disclosed by Toyama, which is made of polyvinyl acetal etc., has no relation to the polishing pad for a semiconductor wafer as the present invention, and obviously differs from the polishing pad in terms of structures and materials.

Thus, none of the cited references relates to the polishing pad for a semiconductor wafer, and all completely differ from the polishing pad in terms of structures and materials. Therefore, even if the cited references are considered, the polishing pad according to claim 11 of the present application cannot be derived.

Each of claims 12, 13 and 20 as amended relates to a polishing pad having the same structure and material as claim 11. Therefore, for the same reasons as claim 11, claims 12, 13 and 20, and claims dependent therefrom, should not be rejected.

Each of claims 27-30 as amended relates to a method for polishing a semiconductor wafer with the above polishing pad. It is obvious that as long as the polishing pad of the present invention cannot be derived from the cited references, these polishing methods cannot also be derived. That is, the polishing methods of claims 27-30 should also not be rejected for the same reason as claim 11.

For the foregoing reasons, reconsideration and withdrawal of this rejection are respectfully requested.

III. Rejection Under 35 U.S.C. §103(a)

Claims 11-18 and 20-31 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over "Applicants' Prior Art" in view of Cercone. This rejection is respectfully traversed.

As mentioned above, Cercone relates to a cleaning sponge roll used after polishing, which is completely different from a polishing pad in terms of both structure and material.

Further, it is natural to reduce, as much as possible, metal particles such as zinc contained in the cleaning sponge used finally after polishing in manufacturing a semiconductor wafer, but it is not obvious to apply the cleaning sponge of Cercone to the polishing pad. As mentioned above, the present invention could only be derived from the findings by the present inventors that minute polishing damages in the polishing process of the semiconductor wafer were caused by zinc oxide added in manufacturing of the polishing pad for mirror-polishing, but cannot be derived from Cercone and "Applicants' Prior Art".

Thus, it is not agreed that one would have been led to combine the teachings of "Applicants Prior Art" and Cercone as alleged in the Office Action, or that such combination would have led one to the claimed invention.

Further, contrary to the assertion in the Office Action, it is not seen where "Applicants' Prior Art" (cited as "e.g., page 1" in the Office Action) satisfies any of the structure or materials limitations of the amended claims. It is not seen that a polishing pad having the presently claimed structure (base layer formed of nonwoven fabric and a porous surface layer formed of foamed polyurethane) is admitted. Cercone also provides none of these requirements as discussed extensively above.

For all the foregoing reasons, Applicants submit that neither "Applicants' Prior Art" nor Cercone, considered separately or together, teach or suggest the presently claimed invention. Reconsideration and withdrawal of this rejection are respectfully requested.

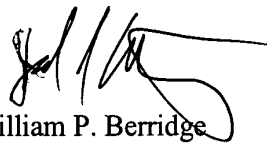
IV. Conclusion

As explained above, the inventions of claims 11-13, 17, 18, 20, 21 and 27-30 as amended completely differ from the cited references, and further cannot be derived from these references or "Applicants' Prior Art."

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 11-13, 17, 18, 20, 21 and 27-30 are respectfully requested.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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